COVER LETTER

Official Title: A Telemedicine Prenatal Care Model on Low Risk Pregnants: The m@Mae-e Study.

NCT number: 48740621.9.0000.5335

Document date: 23th February, 2023.

DECLARATIONS

Ethics Approval and Consent to Participate

The proposed study was designed based on ethical and scientific requirements for research involving human beings, presented in the Resolution by the Health National Committee of the Ministry of Health 466/12 (22). The project was approved by the IRB of the Irmandade Santa Casa de Misericórdia of Porto Alegre (Resolution 4.915.640) and in accordance with international recommendations for clinical research and interventions in human beings. Pregnant women will be required to read the informed consent and confirm their interest in participating in the research before study entry. As a direct benefit, all pregnant women will be invited to participate in online educational activities during prenatal care and will have a puerperal consultation, in which they can reply to the questions about breastfeeding, baby care, and contraception and have their mental health assessed. With regards to risk that might apply to this research, it implies that there will be a lower personal contact assessments for those pregnant women allocated to telemedicine prenatal care model, even though they will have availability to access to wearable and 24/7 and also access to obstetric emergence, whenever necessary.

Consent for publication: Not applicable.

Availability of data and materials

Summaries of the results and other relevant information will be published on the eRegistries website. All data generated or analysed during this study are included in this published article (and its supplementary information files).

Competing interesting

Authors declare no competing interesting.

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Author´s contributions: Conceptualization, Methodology, Data curation, Writing-Original draft, Writing - Review & Editing: TC, AS, LC. Methodology, Data curation, Data Visualization and Analysis: AJB, BNF. Data Visualization and Analysis: SCC, CDT. All authors contributed to interpretation of the data, revision of the manuscript, and approved the final manuscript. AS is the guarantor. The corresponding author attests that all listed authors meet authorship criteria and that no other meeting the criteria has been omitted.

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ABSTRACT

Background: COVID-19 pandemic and its social isolation has increased awareness of barriers to obstetric care, resulting in lower access for pregnant and postpartum women and forcing health care providers to redesign antenatal care service models. The adequacy of the Brazilian prenatal care model aims to ensure attendance, even in situations of high logistical complexity. **Methods:** This is a superiority hypothesis randomized clinical trial protocol, comparing telemedicine prenatal care to traditional prenatal care for low-risk pregnancies. This is an unstratified 1:1 allocation ratio, with a follow-up of 41 weeks (IG: 6 to 41 weeks and 06 weeks postpartum). This study also includes pregnant and postpartum women assessment of anxiety and economic evaluation of this new technology proposed. **Results**: We proposed a model of telemedicine prenatal with at least 6 in person appointments and 3 online appointments for low-risk pregnant women, based on guidelines of international and national guidelines, the study only will be start after research protocol publication and peer reviews. **Discussion:** The development of a guideline for a hybrid in-person-virtual prenatal care model aiming at reducing face to face medical appointments may lead to lower costs and decrease transmission of SARS-CoV-2 in the community, in with, activities will enable a similar effectiveness, and no reduction to the quality of care. **Trial Registration:** 48740621.9.0000.5335.

Keywords: prenatal care, COVID-19, telemedicine, health technology assessment, management guideline, randomized clinical trial.

Trial registration: 48740621.9.0000.5335. Approved at DATA, 2023.

BACKGROUND

COVID-19 is a viral infection caused by SARS-CoV-2, which spreads primarily via respiratory droplets during close face-to-face contact (1). Pregnant women are known to be disproportionately affected by respiratory illnesses, which are associated with increased infectious morbidity and high maternal mortality rates (2). In this scenario, many expecting mothers are unable to visit the clinician or health center, especially in developing countries; this might lead to missing out on high risk factors in due course of pregnancy (3). Remote care enables a provision of obstetric care at contingency plans, in order to minimize antenatal visits, as it limits an exposure to SARS-CoV-2 for healthy pregnant women and also for healthcare providers (4). Telemedicine can potentially mitigate potential adverse effects of reduced antenatal visits. Several studies have shown that telemedicine is an effective strategy, in which applying evolving telemedicine capabilities can improve good quality care for obstetric patients (5). A systematic review suggests that obstetrical telemonitoring has a great potential for contributing with better gestational outcomes, early detection of complications, prevention of intercurrences, and providing rapid intervention even before hospitalization (6). Some studies suggest that reduced-frequency prenatal care model, technology-enhanced, is as safe as the standard model of care for low-risk pregnant women (7). Although, there is low-grade evidence published, Brazil has an incipient regulation of telemedicine and, therefore, most prenatal care has been conducted face-to-face. Here we describe a research protocol of a study whose objective is to assess the feasibility of conducting a randomized controlled trial on the effectiveness and the cost-effectiveness of prenatal care telemedicine. The null hypothesis to be tested in this study is that

there is no difference in (cost-) effectiveness on maternal health outcomes between patients undergoing standard prenatal care compared to those receiving telemedicine for prenatal care.

METHODS/DESIGN

Unblinded, parallel group, randomized controlled trial

Superiority randomized controlled trial (RCT), comparing standard prenatal care and telemedicine prenatal care, with allocation ratio 1:1 and maximum follow-up 41 weeks (6 weeks pregnancy to 6 week postpartum) will be conducted. The primary outcome will be maternal anxiety and clinical effectiveness of both approaches. The SPIRIT guidelines (8) will be applied to assess the current RCT, and it is included in Appendices. A cost effectiveness study will also be conducted in the present study. The trial is registered to the International Standard Randomized Controlled Trial Number 48740621.9.0000.5335.

Setting

This study will be conducted at Santa Casa de Misericórdia of Porto Alegre - Santa Clara Hospital - Mario Totta Maternity (MTM), a teaching institution for residency and academic training in obstetrics. On average 3000 pregnant women attend prenatal care at MTM, by Brazil's Public Health System – the SUS (Unified Health System) every year, 14% of which are considered low- risk pregnancies. The MTM catchment area includes local, metropolitan and also regional population and has approximately 3000 deliveries per year.

Participants

The population of study includes every pregnant woman who seeks care in the obstetric outpatient clinics at Santa Casa antenatal care, by SUS and is classified as a low-risk pregnant. Those women who attend their first antenatal care at 6 to 12 weeks gestation at MTM using the public health system (SUS) will be screened for this study. We will classify low-risk according to the Brazilian Ministry of Health criteria, which includes patients that have no individual or social risk factors or history of previous obstetric complications, or any disease or condition that may interfere negatively in the pregnancy course (9). This criteria has been validated in several studies that had been carried out in Brazil, in which the prenatal care model is focused on well-being and safety of low-risk pregnant women (7) (10) (11).

Eligibility criteria

Inclusion criteria: Low-risk pregnant women, age between 18 to 34 years; gestational age less than 13 weeks at the first consultation and Portuguese native speaker.

Exclusion criteria: Patients with clinical evaluation of high-risk pregnancies will be excluded, including chronic hypertension, diabetes mellitus, obesity, multiple pregnancies, severe COVID-19 infection, previous thromboembolic event, acute or chronic hematological events (eg, thrombus formation isolated to thrombophilia), use of anticoagulants, cardiovascular disease, lung disease, kidney disease, immunosuppression, severe mental disorder, recurrent abortion, previous premature birth, previous or current cancer.

Sample size and power calculation

The sample size calculation was based on the primary outcome - difference between scores on the GAD-7 anxiety scale -, compared to means, estimated at 4 points, and standard deviation of 4 points. A sample of 26 patients each group is needed to have 80% power, at the 5% significance level; considering losses of 15% in the follow-up, the final size of the intended sample will be 60 patients. Recruitment will continue until target sample size is reached. The sample was calculated using the formula for superiority randomized clinical trials proposed by WANG et al., 2017 (Figure 1):

$$n_1 = \left\lceil \frac{(z_\alpha + z_\beta)^2 (\sigma_1^2 + \sigma_0^2 r)}{(d-\delta)^2} \right\rceil,$$

$$n_0 = \left\lceil \frac{(z_\alpha + z_\beta)^2 (\sigma_1^2 / r + \sigma_0^2)}{(d-\delta)^2} \right\rceil.$$

Figure 1: formula for superiority randomized clinical trials.

Recruitment

The recruitment population includes pregnant women presenting for their first antenatal visit at 6 to 12 weeks of gestation. Participation in the study will be followed until completion of the postpartum period.

Eligible participants will receive information about study design, objectives, risks and benefits in adapted language, participant information leaflet and participant consent form (Appendices).

Randomisation

The randomization process in this RCT will use random permuted blocks to ensure similar numbers of participants in each intervention arm throughout the trial and

equal numbers in each arm by the end of the study. Blocks of varying length will be used to reduce the predictability of the allocation sequence. In advance of participant recruitment, an independent researcher will be responsible for generating the allocation sequence using the Stata program (version 2.0). Sealed envelopes will be used to assign participants to intervention groups. Thus, the allocation sequence will be concealed from all study researchers until the interventions are assigned, unless major adverse events or unexpected inconsistencies occur in the follow-up to the study.

Interventions

All eligible women who consent to participate in the study will be randomized into either usual prenatal care (UPC) or telemedicine prenatal care (TPC). The antenatal scheduling process will be similar between groups. In the UPC all appointments (at least 9) will be in person. Participants assigned to the TPC group will perform at least 6 in person appointments and 3 online appointments through the Google Meet platform; this group will have wearable for blood pressure and fetal heart home monitoring, as needed according to the guidelines defined previously by the Obstetric Outpatient Department. Consent for teleconsultation and medical device use at home will be obtained. In situations where Google Meet or internet isn't available, the appointments will be carried out by video call. Pregnant women from both arms of the study will receive standard care from the obstetric team. Clinical management will be based on evidence-based guidelines used at MTM, which is currently being revised to include remote antenatal care and will be finalized and available before collection of data. Santa Casa Hospital will provide all necessary laboratory and imaging tests. Participants from both arms of study will be advised to

seek obstetric emergency in case they are feeling some discomfort or pain, have any complications or need any further evaluations.

Variables and data collection

Data collection has four components: baseline demographic characteristics, quality of life and economics data, anxiety scores and clinical outcome data. Undergraduate medical students and Gynecology and Obstetrics residents, trained in conducting diagnostic assessments, will collect data and apply the standardized questionnaires.

In order to compare participants in both arms, data on clinical risk factors and socioeconomic status will be collected during the recruitment phase, using the baseline characteristics questionnaire (Table 1).

Chart 1: Baseline characteristics questionnaire

	Variable	Description or Categories
Demographic characteristics	Distance from capital	In kilometers (km)
	Age	In years
	Skin color	White, black, asian, brown, indigenous
	Marital status	Single, married/living together, separated/divorced, widowed
	Scholarity	Elementary, high school, youth and adult education, higher education
	Occupation	Currently performed job
	Work situation	Employee with a formal contract, employee without a formal contract, civil servant, self-employed, unemployed
	Working hours per day	In hours
	Income	In Reais
	People living on this income	01, 01 to 03, 04 or more
	Children who live on this income	01, 02, 03, 04 or more
Clinical characteristics	Weight at 1st medical appointment	In kilograms (Kg)
	Height	In centimeters (cm)
	Blood pressure at 1st medical appointment	In millimeters of mercury (mmHg)
	Prior parity	Number of pregnancies, abortions, childbirth, cesarean sections, molar and ectopic pregnancies
	History of premature birth or stillbirth	Yes or no
	Comorbidities	Describe chronic diseases
	Chronic use medications	Describe medications in use

Outcome variables

Severity of anxiety among pregnant women and postpartum women will be evaluated by GAD-7 scale (Chart 2), which has been validated for assessing anxiety

in pregnant women, in a study developed by Zhong and collaborators (13). This scale had good reliability, internal and external validity; patients with scores greater than or equal to 07 required careful follow-up (13).

Health-related quality of life will be assessed using the Portuguese version of the EQ-5D (Chart 3) (14). This questionnaire was developed by the EuroQol group and is recommended by Health Technology agencies worldwide as a key outcome measure for the use in cost-effectiveness analysis (15). The EQ-5D includes five dimensions of health (i.e., mobility, self-care, usual activities, pain/discomfort and anxiety/depression) which are used to describe the health state of the participants according to 3 levels of response (no problems, some problems and extreme problems) resulting in 243 health states. The participants' health states obtained from the EQ-5D responses will be scored using the Brazilian value set (12).

Chart 2: GAD-7 scale

GAD-7				
During the past 2 weeks, how often have you been bothered by the troubles below? (Mark your answer with "X")	Not once	Several days	More than half the days	Almost everyday
1. Feeling nervous, anxious or very tense	0	1	2	3
2. Not being able to stop or control worries	0	1	2	3
3. Worrying a lot about many things	0	1	2	3
4. Difficulty to relax	0	1	2	3
5. Getting so agitated that it is hard to sit still	0	1	2	3
6. Getting easily annoyed or angry	0	1	2	3
7. Feeling scared as if something horrible is going to happen	0	1	2	3
(For office coding: Total Score T = _____ + _____ + _____)				

Chart 3: EQ-5D questionnaire

EQ - 5D
Mobility
I have no problems in walking about
I have some problems in walking about
I am confined to bed
Self-Care
I have no problems with self-care
I have some problems washing or dressing myself
I am unable to wahs or dress myself
Usual Activities (e.g. work, study, housework, family or leisure activities)
I have no problems with perffoming my usual activities
I have some problems with perffoming my usual activities
I am unable to perform my usual activities
Pain/Discomfort
I have no pain or discomfort
I have moderate pain or discomfort
I have extreme pain or discomfort
Anxiety/Depression
I am not anxious or depressed
I am moderately anxious or depressed
I am extremely anxious or depressed

Four categories of costs will be collected: (1) Intervention costs and usual care costs, (2) Healthcare costs (i.e., medication costs, primary, secondary, and tertiary costs), (3) Informal care costs (i.e., transportation costs, caregiver costs, internet costs), and (4) Lost productivity costs. Intervention costs will be calculated using a bottom-up approach in which the resources consumed by the intervention will be collected (i.e., minutes spent in the teleconsultation by the obstetrician). Costs related to the use of health services (i.e., healthcare costs) and costs incurred by the patient and family (i.e. informal care costs) will be measured using an adapted version of questionnaires developed by Vidal and collaborators (16) and by researchers of the Stringer study (17) (Chart 4). Lost productivity costs (i.e., absenteeism from work and presenteeism) will be measured using an adapted version of the *i*Productivity

Cost Questionnaire (*i*PCQ) developed by researchers of the Institute for Medical Technology Assessment (iMTA) (18). All costs will be measured at prenatal trimestral appointments and will cover the period between appointments (i.e., 3 months). Costs will be evaluated according to the to the Brazilian Public Health reimbursement table of Sistema de Gerenciamento da Tabela de Procedimentos, Medicamentos e OPM do SUS (SIGTAP)(19), to the Instituto Brasileiro de Geografia e Estatística (IBGE)(20).

Chart 4: Costs related to prenatal care.

Estimated personal costs for adherence to prenatal care		
Work	Current job	Describe
	Job loss due to pregnancy?	Yes or No
	Do you have regular employment?	Yes or No
	Do you have leave for medical appointments?	Yes or No
	Working time lost to attend the medical appointments	In hours
Transport	Means	On foot, municipal van, bus, app, own vehicle
	Cost	In Reais
	Time	In minutes
Children under guardianship	Children under 12 years old in their responsibility	Quantity
	Do they need to stay with a caregiver for the medical appointment?	Yes or no, estimated cost in Reais
	Do they attend daycare or school? Public or private?	Yes or no, estimated cost in Reais
Companion	Does a partner or family member need to miss work to accompany you to medical appointments?	Yes or no, estimated cost in Reais
Telemedicine	Do you have a computer with internet at home?	Yes or No
	Do you have a cell phone with internet access?	Yes or No
	Estimated monthly cost for internet access/hour	In Reais

Clinical outcomes will be collected to explore the clinical effectiveness of the TPC based on hospital database reviews (Chart 5).

Chart 5: Maternal-fetal outcome and puerperal aspects

Maternal-fetal outcome and puerperal aspects	
Delivery methods	Vaginal or cesarean
Gestational age at birth	preterm, term, post term
Maternal complication	Infectious, hemorrhagic, none, other
Newborn's size	Small, appropriate, large for gestational age
Need for neonatal ICU	Yes or No
Breast-feeding	Yes or No; time and reason
Need to return to obstetric emergency	Yes or No; reason
Need for medical appointments in pediatric emergency	Yes or No; reason

Outcomes

Primary outcome: Mean between-group differences in GAD-7 scores.

Secondary outcome 1: difference between means, between groups, of data related to the mother: delivery mode and obstetric complications.

Secondary outcome 2: difference between means, between groups, of data related to the baby: gestational age at birth, birth weight, APGAR, neonatal intensive care unit (ICU) admission.

Secondary outcome 3: economic analyses.

The quality of assistance will be evaluated by the Humanization Program for Prenatal and Birth (PHPN) criteria proposed by Brazil Ministry of Health (21). Adherence to the proposed care will be assessed by attending the consultations, carrying out the proposed exams and extra consultations in the Obstetric Emergency. The schedule intervention was present at Figure 2.

Figure 2: Flow Chart of recruitment, intervention and evaluations

Figure 1: Flow Chart of recruitment, intervention and evaluations

	Study period							
	Screening	Allocation	Post Allocation					Finalizatio
MOMENT	*-t1*	0	*t1*	*t2*	*t3*	*t4*	*t5*	*t5*
RECRUITMENT								
Eligibility evaluation	X							
ICF *		X						
Allocation		X						
INTERVENTION								
SG and GC: In-person queries			X	X	X	X		
SG: Telemedicine consultations			X	X	X	X		
EVALUATION								
Sample ascription		X						
Anxiety (GAD-7)			X	X	X	X		
LQ and costs (E5-5D) Personal costs			X	X	X	X		
Implementation costs							X	
Clinical Outcomes							X	
Feasibility								X
Accession								X
Quality (PHN)								X
Cost-effectiveness								X

Legend
t1 Initial eligibility evaluation through referral to the PN
T0 Allocation based on eligibility criteria
t1 First Trimester
t2 Second trimester
t3 Third trimester
t4 Puerperium

Analysis plan

This RCT will have an analysis by intention-to-treat and per protocol (at least 6 sessions attended) since it is an RCT of effectiveness. The primary outcome will be analyzed by generalized linear models of mixed effects (GLMM) or by generalized estimation equations (GEEs). Adjustments for confounding or baseline variables may be made if justified. Secondary outcomes can be analyzed in 2-test linear models using the Mantel-Hanszel test, linear trends for ordinary categorical variables or multivariate regression models for categorical variables. For repeated measures, the same analysis of the primary outcome (GLMM or GEEs) will be maintained. The

level of significance for the statistical tests conducted will be 5% and effect estimates will be presented with 95% confidence intervals.

The cost-effectiveness and cost-utility analysis will be carried out following the intention-to-treat principle according to the randomized clinical trial dataset (22) in software R. The differences in cost and effect will be estimated using a set of equations of apparently non-correlated regressions, which adjusts the model to correlate costs and effects and also allows adjustment for potential confounding factors. The incremental cost-effectiveness ratio (ICER) will be calculated by dividing the difference in costs between interventions by the difference in effect between interventions. Bias-corrected accelerated bootstrapping with 5000 replications will be used to estimate uncertainty around costs and effects. The cost-effect pairs, results of 5000 bootstrapping replications, will be plotted in cost-effectiveness plans (CE-plan) (23). The cost-effectiveness acceptability curves (CEACs) will be estimated to show the probability that the intervention will be cost-effective compared to the control, in different amounts of willingness to pay (that is, the amount in Reais that the health system is willing to pay per unit of effect won) (23). Multiple imputation will be used to predict missing data. The data imputation model will include variables associated with the missing data (24).

Data protection and participant confidentiality

Data acquired according to this protocol will be stored in a password-protected database on a secure network. All entries will be made by an authorized member of the investigator's staff. Data will be entered into the study database and verified through the use of programmed edit checks for accuracy and completeness. The corrected data and a complete audit trail of corrections will be retained. An internal

audit of a sample of the data will be conducted quarterly to assure quality. The investigator will ensure that participants' anonymity is maintained. Participants will not be identified by their names, but by their assigned identification number and initials. Signed informed consent forms, will be maintained securely. Only authorized members of the investigator's staff will have access to the final trial dataset. All information regarding the study data or results supplied to the investigator is privileged and confidential information. The investigators agree to use this information to accomplish the study and will not use it for other purposes.

Safety management

The research team will be composed of a principal investigator, co-investigators and a trial statistician. A data monitoring committee is not required as the study management group will liaise every month to review interim analysis and monitor adherence. The principal investigator will make the final decision to terminate the trial in the event that uptake rates fall below pre-trial levels in either intervention arm. It is not anticipated that there will be premature ends of study. However, if this occurs, then the data will be analyzed and results circulated among the team members. The ethics committee will be notified of any premature termination and the reasons for termination. Adverse events or other unintended effects of trial interventions that come to the attention of trial investigators will be reported immediately to the study management Group. All protocol amendments will be submitted to the ethics committee for review and approval before implementation and to trial registries.

Trial status

This study protocol aims at disseminating and discussing a new model of prenatal care. It will be presented at the IRB of the Irmandade Santa Casa de Misericórdia de Porto Alegre and after approval the recruitment will start.

Dissemination policy

This protocol follows the Standard Protocol Items for reporting: Recommendations for Intervention trials (SPIRIT) guidelines. We will inform all users and stakeholders and publish the results of the CRCT in peer-reviewed open-access journals. The final manuscript will be written based on the recommendations of the Consolidating Standards of Reporting Trials (CONSORT) guidelines for parallel and superiority trials. Results will also be presented at scientific meetings and congresses. We will report any change in the study outcomes, study design, sample sizes, or significant administrative aspects that will impact the study's design when disseminating the findings. Authorship will be in line with the recommendations of the International Committee of Medical Journal Editors. Knowledge translation tools will be carried out to disseminate the study for the population.

RESULTS

We proposed a model of telemedicine prenatal with at least 6 in person appointments and 3 online appointments for low-risk pregnant women, based on guidelines of international and national guidelines, the study only will be start after research protocol publication and peer reviews.

DISCUSSION

This study aims the development of a guideline for a hybrid in-person- virtual prenatal care model. This new model of care aiming at reducing face to face medical appointments, particularly important in COVID-19 pandemic and in distant communities, with restricted access to specialists, especially in a country of continental dimensions such as Brazil. Complemented by the economic evaluation of the proposed new technology, aims to enable a similar effectiveness, with no reduction to the quality of care and reduced costs.

In the scenario of uncertainty of COVID-19 pandemic and in consonance to principle of non-malfeasance, pregnant women were recommended to carefully follow the non-pharmacological countermeasures, such as social distancing, hand hygiene and use of masks, restricting themselves to leave home only for prenatal appointments and to perform complementary tests - which, paradoxically, became potentially a risk event. Some pregnant women did not attend medical appointments, especially in developing countries; as a consequence, screening for gestational risk factors was hampere (5). Maternal-fetal care is essential. Pregnant women who do not attend antenatal services are at increased risk of maternal death, unfavorable perinatal outcomes, and stillbirth. There is evidence of a difference in stillbirth incidence between the pre-pandemic and pandemic period reporting 9.31/1000 live births versus 2.38/1000 live births, $p = 0.01$), showing a marked increase in the number of stillbirths in the pandemic transition. The adoption of health care models that include telemedicine is still a challenge in middle-income countries; however, it is of fundamental importance in expanding access and reduces infant and maternal morbidity. Despite the pandemic, pregnant women need to follow up on prenatal

care; even if barriers imposed by the situation have to be overcome or new approaches to care have to be taken (26).

Evidence on the impact of the number of antenatal visits on maternal and fetal outcomes is limited; similarly, while some studies point to reducing the number of visits, home care, and group care as safe, robust clinical trials with comparative results are not available (27). A systematic review by Villar concluded that, for usual-risk pregnant women, a reduction in the number of consultations does not imply worse maternal-fetal outcomes. Similarly, a study by Partridge demonstrated that fewer than 10 prenatal visits were not associated with worse fetal outcomes such as low APGAR, ICU admission, and neonatal death (28).

The pandemic by COVID-19 and the need for social distance has amplified barriers to obstetric care; forcing providers and health systems to rethink access to care (29). Often lauded for its ability to increase access to healthcare among geographically dispersed patient populations, telehealth has emerged as a strategy designed to solve many of these challenges imposed by the pandemic at the local level (29). Prenatal care should be provided through the incorporation of welcoming behaviors; the development of educational and preventive actions, without unnecessary interventions and easy access to quality health services (30). Countries such as the United States, Israel, and China already use telemedicine in maternal-fetal care. In Pennsylvania, a model of prenatal care via telemedicine, developed to expand access to pregnant women living in remote areas, has shown good levels of acceptance. In Arkansas, ANGELES - a telemedicine program for monitoring pregnant women - has resulted in early identification of high-risk pregnancies, and researchers have concluded that the combination of face-to-face and telemedicine resources is positive (7). In Canada, a protocol entitled OB Nest was developed to

reduce in-person visits and incorporate telehealth visits into low-risk prenatal care and has been shown to provide reduced stress and increased satisfaction among patients (6). Despite the difficulties, the use of telemedicine in prenatal care is gaining ground, especially for the promotion of lifestyle interventions and prevention of complications secondary to gestational diabetes and hypertension (10). A randomized clinical trial entitled GLOW was conducted in California with 394 pregnant women and demonstrated the effectiveness of telehealth in preventing gestational overweight and improving levels of insulin resistance in overweight and obese pregnant women (10). Favorable results have also been reported Ridgeway and colleagues who developed hybrid obstetric care models and by Ridgeway who modernized obstetric care at Mayo Clinic Rochester (11). A study involving 300 pregnant women evidenced that the current routine prenatal and puerperal appointments do not match the preferences of patients, who are open to alternative models of prenatal care, including remote monitoring (6).

The development of guidelines on telemedicine services contributes greatly to the consistency of services provided and ensures patients safety of services, thus developing a guideline for prenatal care through telemedicine is of fundamental importance; empowering pregnant women for this new model is to shift the focus of care from disease to a state of well-being, especially in usual risk pregnancies (32). It is clear that, in the pandemic of COVID-19, the barriers to access prenatal care have increased, resulting in risks for pregnant and postpartum women and babies.

The possible difficulties to be encountered in the development of this research protocol refer to the large number of evaluations to be developed with the pregnant women throughout the three trimesters of pregnancy and the puerperium. In order to

minimize these issues, we will conduct training for the medical residents involved in the research.

LIST OF ABBREVIATIONS

SARS-CoV-2

Randomised controlled trial (RCT)

Mario Totta Maternity (MTM)

SUS (Unified Health System)

Usual prenatal care (UPC)

Telemedicine prenatal care (TPC)

ICU intensive care unit

Humanization Program for Prenatal and Birth (PHPN)

Generalized estimation equations (GHGs)

Generalized linear models of mixed effects (GLMM)

Incremental cost-effectiveness ratio (ICER)

Cost-effectiveness plans (CE-plan)

Cost-effectiveness acceptability curves (CEACs)

CNS Conselho Nacional de Saúde

MS Ministério da Saúde

REFERENCES

1. Wiersinga WJ, Rhodes A, Cheng AC, Peacock SJ, Prescott HC. Pathophysiology, Transmission, Diagnosis, and Treatment of Coronavirus Disease 2019 (COVID-19): A Review. JAMA. 25 de agosto de 2020;324(8):782–93.
2. Dashraath P, Wong JLJ, Lim MXK, Lim LM, Li S, Biswas A, et al. Coronavirus disease 2019 (COVID-19) pandemic and pregnancy. Am J Obstet Gynecol. junho de 2020;222(6):521–31.
3. Aziz A, Zork N, Aubey JJ, Baptiste CD, D'alton ME, Emeruwa UN, et al. Telehealth for High-Risk Pregnancies in the Setting of the COVID-19 Pandemic. 2020; Disponível em: https://doi.org/
4. Zangmo R, Kumari A, Garg D, Sharma KA. Redesigning routine antenatal care in low resource setting during COVID-19 pandemic. J Fam Med Prim Care. 30 de setembro de 2020;9(9):4547–51.
5. Madden N, Emeruwa UN, Friedman AM, Aubey JJ, Aziz A, Baptiste CD, et al. Telehealth Uptake into Prenatal Care and Provider Attitudes during the COVID-19 Pandemic in New York City: A Quantitative and Qualitative Analysis. Am J Perinatol. agosto de 2020;37(10):1005–14.
6. Alves DS, Times VC, da Silva ÉMA, Melo PSA, Novaes M de A. Advances in obstetric telemonitoring: a systematic review. Int J Med Inf [Internet]. fevereiro de 2020;134. Disponível em: https://pubmed.ncbi.nlm.nih.gov/31816495/
7. Butler Tobah YS, LeBlanc A, Branda ME, Inselman JW, Morris MA, Ridgeway JL, et al. Randomized comparison of a reduced-visit prenatal care model enhanced with remote monitoring. Am J Obstet Gynecol. dezembro de 2019;221(6):638.e1-638.e8.
8. Schulz KF, Altman DG, Moher D, CONSORT Group. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. BMJ. 23 de março

de 2010;340:c332.

9. Silva AA, Jardim MJA, Rios CTF, Fonseca LMB, Coimbra LC. Pré-natal da gestante de risco habitual: potencialidades e fragilidades. Rev Enferm UFSM. 1º de agosto de 2019;9(0):15.
10. Pflugeisen BM, Mou J. Patient Satisfaction with Virtual Obstetric Care. Matern Child Health J. julho de 2017;21(7):1544–51.
11. Ridgeway JL, LeBlanc A, Branda M, Harms RW, Morris MA, Nesbitt K, et al. Implementation of a new prenatal care model to reduce office visits and increase connectivity and continuity of care: Protocol for a mixed-methods study. BMC Pregnancy Childbirth. dezembro de 2015;15(1):323–323.
12. WANG B, WANG H, TU XM, FENG C. Comparisons of Superiority, Non-inferiority, and Equivalence Trials. Shanghai Arch Psychiatry. 2017;29(6):385–8.
13. Zhong QY, Gelaye B, Zaslavsky AM, Fann JR, Rondon MB, Sánchez SE, et al. Diagnostic Validity of the Generalized Anxiety Disorder - 7 (GAD-7) among Pregnant Women. PLoS ONE [Internet]. 27 de abril de 2015 [citado 15 de fevereiro de 2021];10(4). Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4411061/
14. Santos M, Cintra MACT, Monteiro AL, Santos B, Gusmão-filho F, Andrade MV, et al. Brazilian Valuation of EQ-5D-3L Health States: Results from a Saturation Study. Med Decis Making. 2009;36(2):253–63.
15. EuroQol. EQ-5D-3L – EQ-5D [Internet]. 2009 [citado 3 de novembro de 2020]. Disponível em: https://euroqol.org/eq-5d-instruments/eq-5d-3l-about/
16. Vidal M, Vellve K, Gonzalez-Comadran M, Robles A, Prat M, Torne M, et al. Perinatal outcomes in children born after fresh or frozen embryo transfer: a Catalan cohort study based on 14,262 newborns. Fertil Steril. abril de 2017;107(4):940–7.
17. Stringer M, Ratcliffe SJ, Evans EC, Brown LP. The cost of prenatal care attendance

and pregnancy outcomes in low-income working women. J Obstet Gynecol Neonatal Nurs JOGNN. outubro de 2005;34(5):551–60.

18. Bouwmans C, Krol M, Severens H, Koopmanschap M, Brouwer W, Hakkaart-van Roijen L. The iMTA Productivity Cost Questionnaire: A Standardized Instrument for Measuring and Valuing Health-Related Productivity Losses. Value Health J Int Soc Pharmacoeconomics Outcomes Res. setembro de 2015;18(6):753–8.
19. SIGTAP - Sistema de Gerenciamento da Tabela de Procedimentos, Medicamentos e OPM do SUS [Internet]. [citado 4 de dezembro de 2021]. Disponível em: http://sigtap.datasus.gov.br/tabela-unificada/app/sec/inicio.jsp
20. Brasil. Pesquisa Nacional por Amostra de Domicílios Contínua - PNAD Contínua | IBGE [Internet]. 2020 [citado 22 de novembro de 2020]. Disponível em: https://www.ibge.gov.br/estatisticas/sociais/populacao/9171-pesquisa-nacional-por-amostra-de-domicilios-continua-mensal.html?=&t=o-que-e
21. Ministério da Saúde. Programa de Humanização do Pré-Natal e Nascimento. [Internet]. 2000 [citado 26 de novembro de 2020]. Disponível em: http://bvsms.saude.gov.br/bvs/saudelegis/gm/2000/prt0569_01_06_2000_rep.html
22. Wright, CC., Sim, J. Intention-to-treat approach to data from randomized controlled trials: a sensitivity analysis. J Clin Epidemiol. 2003;iol.
22. Black WC. The CE Plane: A Graphic Representation of Cost-Effectiveness. Med Decis Making. agosto de 1990;10(3):212–4.
24. Fenwick E, O'Brien BJ, Briggs A. Cost-effectiveness acceptability curves--facts, fallacies and frequently asked questions. Health Econ. maio de 2004;13(5):405–15.
25. Rubin DB. Causal Inference Using Potential Outcomes: Design, Modeling, Decisions. J Am Stat Assoc. 2005;100(469):322–31.
26. Goyal M, Singh P, Melana N. Review of care and management of pregnant women

during COVID-19 pandemic. Taiwan J Obstet Gynecol. novembro de 2020;59(6):791–4.

27. Peahl AF, Novara A, Heisler M, Dalton VK, Moniz MH, Smith RD. Patient Preferences for Prenatal and Postpartum Care Delivery: A Survey of Postpartum Women. Obstet Gynecol. maio de 2020;135(5):1038–46.
28. Reynolds RM. Telehealth in pregnancy. Lancet Diabetes Endocrinol. junho de 2020;8(6):459–61.
29. Alves DS, Times VC, da Silva ÉMA, Melo PSA, Novaes M de A. Advances in obstetric telemonitoring: a systematic review. Int J Med Inf [Internet]. fevereiro de 2020;134. Disponível em: https://pubmed.ncbi.nlm.nih.gov/31816495/
30. Krenitsky NM, Spiegelman J, Sutton D, Syeda S, Moroz L. Primed for a pandemic: Implementation of telehealth outpatient monitoring for women with mild COVID-19. Semin Perinatol. julho de 2020;151285–151285.
31. Ferrara A, Hedderson MM, Brown SD, Ehrlich SF, Tsai AL, Feng J, et al. A telehealth lifestyle intervention to reduce excess gestational weight gain in pregnant women with overweight or obesity (GLOW): a randomised, parallel-group, controlled trial. Lancet Diabetes Endocrinol. junho de 2020;8(6):490–500.
32. Langarizadeh M, Moghbeli F, Aliabadi A. Application of Ethics for Providing Telemedicine Services and Information Technology. Med Arch. outubro de 2017;71(5):351–5.

FIGURE LEGENDS

Figure 1: Formula for superiority randomized clinical trials proposed by WANG et al., 2017.

Figure 2: Flow Chart of recruitment, intervention and evaluations.

CHARTS LEGENDS

Chart 1: Baseline characteristics questionnaire.

Chart 2: GAD-7 scale.

Chart 3: EQ-5D questionnaire.

Chart 4: Costs related to prenatal care.

Chart 5: Maternal-fetal outcome and puerperal aspects.